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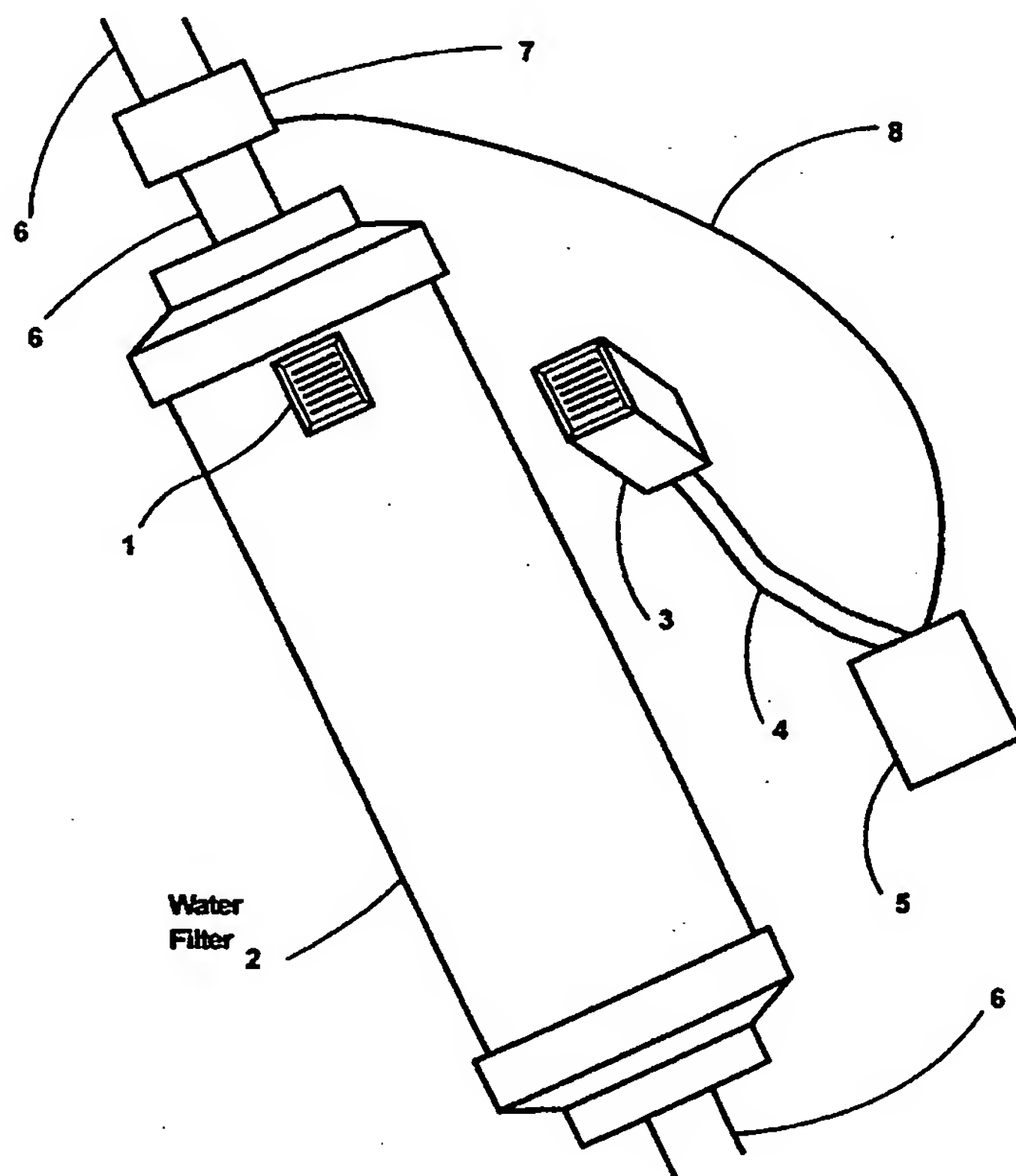
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(54) Title: WATER FILTER MONITOR



(57) Abstract: A water filter (2) equipped with a memory device (1) that monitors the programmed useful life of that water filter - by length of time in use and/or by the total volume of water filtered. This device has the ability to warn the user of imminent filter expiration and, ultimately, of actual expiration, either by time in use or volume filtered, whichever limit occurs first. This device is further capable of transmitting signals, and/or deactivating or activating other functions dependant upon a properly functioning water filter. The memory device (1) is tamper proof and self destructs if tampering is detected or when the life of the water filter (2) has expired, thereby rendering the water filter (2) permanently useless.

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— *Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## **WATER FILTER MONITOR**

### **CROSS REFERENCE TO RELATED APPLICATION**

This application claims benefit of United States Provisional application serial number 60/161,760, filed on October 27, 1999.

### **FIELD OF THE INVENTION**

The present invention relates to a water filter usage monitor, and more particularly, to such a device that prevents further usage of an expired water filter.

### **BACKGROUND OF THE INVENTION**

In recent times, it has become more usual for people to treat their water for better quality and safety, particularly by filtration. Water filters by nature have a finite and specific useful life, and the continued use of an expired water filter may be potentially more dangerous than no water filter at all. Proper and timely replacement of expired water filters relies heavily upon the self-imposed discipline of the user in most water treatment systems. Attempts have been made to force the user to perform these timely filter replacements when required by using audible or visual signals such as a repetitious bell, buzz, or beep, or a glowing or blinking light. In such systems the user is expected to voluntarily replace the water filter and reset the warning system. In reality, users often ignore the warning signal, and just reset the warning system and/or reinsert the old water filter, defeating the original purpose altogether and exposing the users to potentially contaminated and dangerous water. This invention deals with the prevention of user abuse with its inherent dangers as described above by incorporating an inexpensive safety device into any water filtration system.

### **SUMMARY OF THE INVENTION**

The present invention provides a water filter monitoring system designed to provide the manufacturer and end user assurance that a properly functioning water filter is being used at all

times in an active water filtration system, using new and existing technologies in a unique combination.

This invention provides a memory device, preferably a solid state device such as an Electronically Programmable Memory (EPROM) or an Electronically Erasable Programmable Memory (EEPROM) embedded in, attached to, or accompanied with any water filter. This memory device may be custom-programmed to match the longevity specifications of any particular water filter at the point of manufacture (or at a point of final distribution such as a distributor or dealer).

This invention provides a means to acknowledge a new water filter, its remaining life, and when that useful life has expired.

This invention provides means to control or signal the activity or other related functions in a water treatment system dependent upon a properly functioning water filter, such as (but not limited to) valves and pumps, or any other desired activity.

This invention provides computational means to perform all of the above functions in any water treatment system.

This invention provides a means to prevent tampering with the memory device and means to prevent the use of an expired water filter in any water treatment system utilizing this invention.

This invention provides a simple and easy to use connection between the water filter and electronic controls of any water treatment system.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

Other objects, features and advantages will occur to those skilled in the art from the following descriptions of the preferred embodiments, and the accompanying drawing in which:

Figure 1 is a schematic side view of an embodiment of the invention. It depicts the features pertaining to this patent. It does not show the many signals or features that may be utilized by the information provided by this invention.

### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferred embodiment of a water filter monitoring device according to this invention is shown in Figure 1. Water filter 2 has embedded into it, is equipped with, or is accompanied by an Electronically Erasable Programmable Memory (EEPROM) 1, or another solid state memory device. It is joined by connection 3 and wiring 4 to computational device 5. When water filter 2 is installed into a water treatment system by the factory (or as a subsequent replacement), a simple electrical connection is made between EEPROM 1 and connection device 3. A signal to computational device 5 is automatically made and all starting values, including the current date, is written onto the EEPROM 1. A water volume count of zero is also written onto the EEPROM 1. Computational device 5 is factory programmed to the water filter 1 usage specifications of that particular water treatment system. Flow meter 7, placed in water inlet or outlet 6, is connected to computational device 5 by wiring 8. Flow meter 7 may also be replaced by a water pump, and its known pumping rate can be used by computational device 5 to calculate the total flow volume. Flow meter 7 may also be replaced by an in-line collection chamber of known size whereby computational device 5 would calculate total flow volume each time the chamber is emptied.

Water filter reuse is prevented by the above mentioned control electronics. Several overlapping security measures can be used. Each filter 2, both factory installed and replacement units, can be equipped with a security device containing EEPROM 1 of sufficient memory capacity to record all of the necessary security, usage, and dating information. Starting values of the necessary security, usage, and dating information will be set at the time of manufacture of EEPROM 1 and computational device 5. The useful water volume life of filter 2 can be enforced by calculating the total accumulated water filtered by device 7, or by its total time in service.

These are three water filter issues addressed by this invention. Any one or all may be addressed in any product using this invention.

Use life: The total volume of water filtered is enforced by monitoring the volume of water passing through device 7. The total water volume filtered is continuously updated and recorded on EEPROM 1, and compared to a preset number in computational device 5. The EEPROM 1 will self destruct, aided by computational device 5, when this preset number is exceeded. Computational device 5 will provide the user with one or more timely warnings of this imminent happening in order that the user may have a replacement filter 2 on hand.

**Time life:** A specific time life of water filter 2 may be enforced by initially recording the current installation or activation date on EEPROM 1. This date is compared to the expiration date or total time programmed in computational device 5. The EEPROM 1 will be destroyed when the filter time life is exceeded.

**Reuse and destruction:** To prevent reuse or resale of used filter 2, when either the total filtering volume or the time limit is exceeded, computational device 5 will write over all pertinent security data with patterns that indicate the filter is used. The unused sections of EEPROM 1 will then be written and erased repeatedly until the limited number of read/write cycles for EEPROM 1 is exceeded, causing it to fail, thus making it and water filter 2 unusable in the future. This is accomplished in just a few minutes. Without a functioning EEPROM 1, computational device 5 will send appropriate signals to prevent the treatment system to operate (for example, disable the pump, or close a valve). The user will thus be forced to provide a replacement filter 2 with is associated EEPROM 1.

Although specific features of the invention are shown in Figure 1, other potential features are not. This is for convenience only as each feature may be combined with any or all of the other features in accordance with the invention.

Other embodiments will occur to those skilled in the art and are within the following claims:

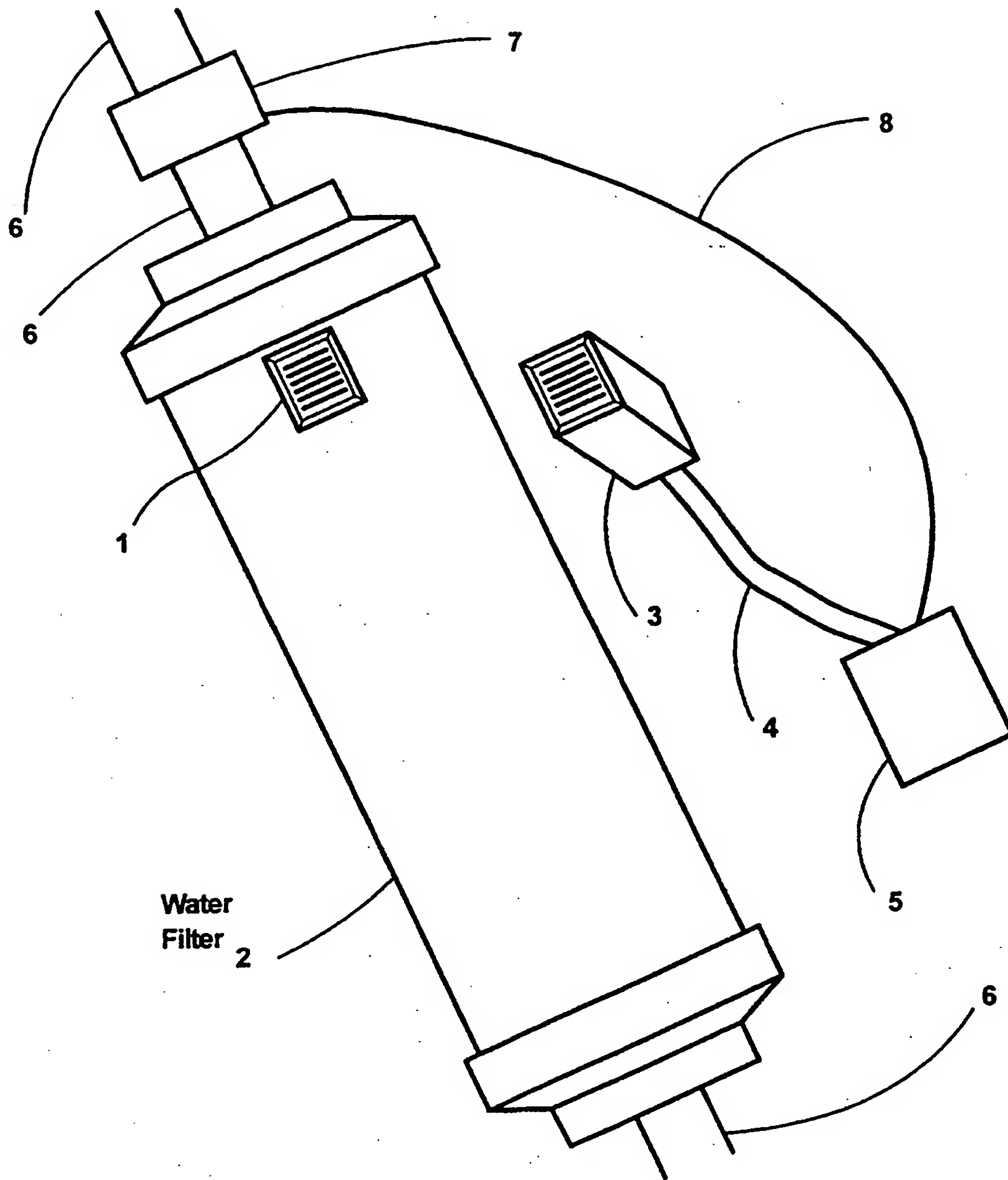
What is claimed is:

1. A water filter monitoring device for rendering a water filter useless based upon the occurrence of a predefined event, comprising:  
a memory device operably connected to the water filter; and  
means for determining the occurrence of a predefined event.
2. The water filter monitoring device of claim 1 wherein the means for determining comprises a filtered water volume determination means.
3. The water filter monitoring device of claim 1 wherein the means for determining comprises a water filter usage time determination means.
4. The water filter monitoring device of claim 1 wherein the predefined event comprises a time period in which the filter is in use.
5. The water filter monitoring device of claim 1 wherein the predefined event comprises a volume of water filtered.
6. The water filter monitoring device of claim 5 in which the monitoring is done at least in part by a flow meter.
7. The water filter monitoring device of claim 5 in which the monitoring is done at least in part with a chamber.



8. The water filter monitoring device of claim 1 further including means, responsive to the means for determining, for warning the user of imminent filter expiration.
9. The water filter monitoring device of claim 1 wherein the memory device is an EPROM.
10. The water filter monitoring device of claim 1 wherein the memory device is an EEPROM.
11. The water filter monitoring device of claim 1 further including means for disabling the water filter if the memory device is tampered with.
12. The water filter monitoring device of claim 1 wherein the memory device is a solid state device.



**Figure 1**

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US00/41540

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : B01D 27/10

US CL : 210/85, 87, 138

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 210/85, 87, 100, 138; 116/264, 273-275; 340/607; 137/552.7

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EAST

search terms: EEPROM, EPROM

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 5,674,381 A (DEN DEKKER) 07 October 1997, see abstract, col. 1, lines 34-46 and col. 2, lines 25-56.	1, 3-4, 8-10 and 12 ----- 11
X --- Y	US 5,814,212 A (HSU) 29 September 1998, see abstract, see col. 5, line 65 to col. 6, line 38.	1-2, 5-6, 9, and 12.
Y	US 5,328,597 A (BOLDT, Jr. et al.) 12 July 1994, see figures 1-2, col. 7, lines 31-41, and col. 9, lines 1-12.	7



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
*A* document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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*O* document referring to an oral disclosure, use, exhibition or other means	
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